NSW HEALTHY FLOODPLAINS

Floodplain harvesting entitlements for the NSW Border Rivers regulated river system

Model scenarios

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Executive summary

In 2008 the NSW Government announced that water users harvesting water from floodplains would need a licence and approval to use the water harvesting works that they had installed. To facilitate this, the Department introduced the *NSW Floodplain Harvesting Policy* in 2013. The policy sets out the floodplain harvesting licensing eligibility criteria and the licensing process where licences define the volume of water (overbank and rainfall-runoff) that users can legally harvest from floodplains. The policy is now being implemented across the northern Murray–Darling Basin.

Floodplain harvesting limits are set out in NSW Water Sharing Plans. These limits were estimated at the time of policy introduction and are now being updated using improved information and modelling developed under the NSW Floodplain Harvesting Program.

This report describes how the Border Rivers Valley river system model (described in the companion Model Build report – Department of Planning, Industry and Environment Water, 2020a) has been used to recalculate the long-term diversion limit set in the Water Sharing Plan for the NSW Border Rivers Regulated River Water Source (referred to as the 'Plan Limit') and estimate individual floodplain harvesting entitlements. Model scenarios have been developed that represent different combinations of levels of development, entitlements and account management rules to ensure equitable distribution of the individual floodplain harvesting entitlements.

Each scenario is run through the Border Rivers Valley river system model, over the period 1 July 1895 to 30 June 2009, to calculate an estimate of long-term average annual total diversion. Issues such as compliance with the Plan Limit, equitable distribution of entitlements and risk of growth in use are considered when evaluating the entitlements and account management rules.

Comparing results of diversions permitted under the existing Plan Limit against current levels of development and management rules shows that, as a consequence of growth in development, total long-term average diversions have increased by around 6 GL/year with around 13% growth in floodplain harvesting. Introducing combinations of entitlements and account management rules to reverse this growth results in a 13% reduction in floodplain harvesting. Under this scenario, floodplain harvesting reduces from 43.6 GL/year under current conditions to 38.0 GL/year, which is 0.7 GL/year below the Plan Limit estimate.

These impacts don't occur in every year; reductions primarily occur after a series of wet years. Impact on individual properties has been tested using an individual impact scenario which shows that the impacts are equitably distributed with reduction in floodplain harvesting of around 12% for all properties when compared to the harvesting that could occur with eligible works. Some properties will have impacts greater than 12% as they have ineligible works which are not included in the entitlement determination process.

While all care has been taken in this modelling and the work undertaken has substantially improved the estimation of floodplain harvesting, uncertainty can be further reduced with better information. This will require ongoing measurement and monitoring of harvesting volumes and management practices, and better representation of return flows from floodplains to river channels.

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1 Introduction

In 2008 the NSW Government announced that water users harvesting water from floodplains would need a licence and an approval to use the works. To facilitate this, the Department developed the *NSW Floodplain Harvesting Policy* (the policy). The policy was introduced in 2013 and is now being implemented across the northern Murray-Darling Basin. The policy sets out the floodplain harvesting licensing eligibility criteria and the licensing process.

Floodplain harvesting licences define the volume of water that users can legally harvest from floodplains. Bringing floodplain harvesting into the water licensing system will enable management of diversions within the limits established in NSW *Water Sharing Plans* (WSPs) for each valley.

NSW WSPs set out how much, and how, water is shared between users within the State. They define how limits to total diversions, including for floodplain harvesting, are to be calculated in each valley, and include estimates for these limits. The floodplain harvesting estimate is now being updated using improved data and methods developed under the NSW Floodplain Harvesting Program.

The updated data and modelling for the NSW Border Rivers Valley regulated river system are described in detail in the companion Model Build report (Department of Planning, Industry and Environment Water, 2020a).

The purpose of this report is to describe how this model has been used to recalculate the diversion limit set in the Water Sharing Plan for the NSW Border Rivers Regulated River Water Source 2009 (updated 2018) (the Border Rivers WSP*)* and calculate floodplain harvesting licences to ensure that total diversions are within that limit.

1.1 Border Rivers Valley river system model

The model of the regulated river system of the Border Rivers (Border Rivers Valley river system model) (Department of Planning, Industry and Environment Water, 2020a) was built to:

- support the policy and planning development and implementation in this water system, including its contribution to the Murray–Darling *Basin Plan 2012* (the Basin Plan). This includes being able to estimate the Baseline Diversion Limit (BDL) and Sustainable Diversion Limit (SDL) as required by the Basin Plan
- determine volumetric floodplain harvesting entitlements as required by the policy.

The model was developed using multiple lines of evidence and best available industry data to ensure that the assessment of floodplain harvesting capability at each irrigation property is realistic. Assessment criteria[1] measured how well the model reproduced system behaviour, that is inflows, diversions and flow distribution, necessary to meet the modelling objectives. The Model Build report (Department of Planning, Industry and Environment , 2020a) provides evidence and assessments to demonstrate that the model has made the best use of available data and methods to produce the estimates of limits to diversions required for implementation of the policy. In addition, the quality of the model build process (as described in the Model Build report) has been favourably assessed through several rounds of Independent External Review, with findings publicly available (Alluvium, 2019).

1.1.1 Model scenarios

Meeting policy purposes required configuring and running a set of defined model scenarios. Scenarios reflect a particular level of development and management rules in the river system,

[1] Ref Table 36 in Department of Planning, Industry and Environment Water (2020a)

usually at a point in time. The scenarios to be discussed in this report have been qualitatively defined by the Border Rivers WSP and, separately, by the policy.

Scenarios are developed as modifications to the inputs to the baseline river system model. When run over long-term climate sequences, the modified model can then simulate long-term average annual diversions under the level of development and management rules described in the scenario.

The modifications to create these scenarios are described in this report.

1.2 Report purpose and structure

This report describes how the Border Rivers Valley river system model was used to recalculate the diversion limit in the Border Rivers WSP and estimate individual floodplain harvesting entitlements. This includes discussion of the relevant policy instruments, how models are used to implement these, and how development levels and water management rules (the two key components of the scenarios) were determined.

Section 2 introduces the key elements of the Border Rivers WSP and the policy, particularly the definitions for the Cap and Plan Limit Scenarios, and the framework for establishing floodplain harvesting entitlements.

Section 3 describes the model scenarios and their data requirements in more detail and how they have been combined to estimate floodplain harvesting entitlements.

Section 4 presents the modelled results, summarised at whole of river system scale as required by the Plan and the policy. Results are categorised by (1) determining the Border Rivers WSP's diversion limit, (2) growth in use assessment, (3) Plan Limit compliance, and (4) entitlement distribution. Summary information on individual entitlements is reported, including estimated changes in diversions as a consequence of implementing these entitlements.

Section 5 concludes with an assessment of how the requirements of the policy have been addressed, along with identification of future work.

1.3 Companion reports

How the model has been used to update the Water Sharing Plan limit and calculate floodplain harvesting entitlements to bring total diversions back within that limit is described in this report.

The building of the river system model which provides the data for assessing entitlements is described in companion report Building the river system model for the Border Rivers Valley regulated river system (Department of Planning, Industry and Environment Water, 2020a).

The use of the model results for predicting potential environmental outcomes is described in companion report *Environmental outcomes of implementing the Floodplain Harvesting Policy in the Border Rivers Valley* (Department of Planning, Industry and Environment Water, 2020b).

The three reports together serve to describe how the modelling meets the objectives of the *Floodplain Harvesting Policy*.

2 Floodplain Harvesting Policy background

2.1 Purpose

Allowable limits of water diversions in NSW's regulated rivers and the Barwon-Darling are determined in WSPs established under the *NSW Water Management Act 2000*. Following accreditation of NSW Murray-Darling Basin Water Resource Plans by the Commonwealth Water Minister, on advice from the Murray-Darling Basin Authority, WSPs will be amended to ensure these limits will also reflect the Sustainable Diversion Limit set out in the Basin Plan. These limits allow for flows in the river and on associated floodplains that provide for environmental outcomes and a level of reliability to downstream water users.

Unconstrained harvesting of water from floodplains has resulted in growth in diversions above those limits, resulting in reduced downstream and lateral flow with consequent impacts on reliability of water supply to downstream water users including the environments of the river and its floodplains and wetlands.

The purpose of the policy is to protect the environment and the reliability of downstream water supply by managing floodplain harvesting. These diversions will be managed to be within authorised long-term average annual extraction limits (LTAAELs). This LTAAEL will be henceforth referred to as the 'Plan limit'.

The policy ensures compliance with the *NSW Water Management Act 2000* which requires all diversions to be taken under an appropriate water access licence, a basic landholder right or a licence exemption. The policy also meets the objectives of the National Water Initiative by bringing these diversions into the water access entitlement framework.

2.2 Implementation

The policy provides a framework for licensing floodplain harvesting diversions (comprising overbank flow harvesting and rainfall runoff harvesting), setting out five stages (Figure 1) of the administrative process for eligibility for a floodplain harvesting entitlement, from registration of interest through to the issue of entitlements. The *Implementation Guideline* (Department of Planning, Industry and Environment, 2020) provides further detail on this process.

Figure 1 The 5 stages in floodplain harvesting implementation

DPIE's river system models for each valley are being extended to determine all regulated river floodplain harvesting entitlements, through:

- updating estimates of the Plan Limit defined in each valley's WSP
- assessing floodplain harvesting capability of eligible works
- using the eligible works capability assessment to equitably estimate entitlements such that diversions can be managed within the Plan Limit.

The role of the models in stages 4 and 5 is described in the following sections. Their revision and estimates of Plan Limits rely on information collected in stages 1, 2 and 3.

The entitlements process described here is restricted to the regulated river system. Entitlements in the unregulated river system are determined using a separate process as is outlined in the *Implementation Guideline* (DPIE, 2020).

2.3 Definition and estimates of diversion limits

The policy requires that total diversions do not exceed the Plan limit. This also means that total diversions cannot exceed that allowed for under the Cap[2].

The Plan limit for the Border Rivers is established in Clause 28(1) of the *Border Rivers WSP* as the lesser of the long-term average annual extraction for this water source that would occur:

> "(a) … with the water storages, water use development that existed in 2001/2002, the share components existing at the commencement of this Plan and application of the rules defined in this Plan, or
>
> (b) … under Cap baseline conditions as agreed under the Murray Darling Basin Agreement.
>
> Note: The Cap baseline conditions … are the level of development at 1993-94 with an allowance for an enlarged Pindari Dam. This is deemed to be equivalent to the water use development that existed in November 1999."

The Border Rivers Valley river system model has been designed to be able to determine which set of development conditions and management rules ((a) or (b)) results in the lower long-term average annual diversion. The sets are configured as model scenarios and run through the model, using a long period of climate data, to estimate the long-term average annual total diversion under each scenario.

- Clause 28(1)(a) is configured as the Water Sharing Plan Scenario (the WSP Scenario)
- Clause 28(1)(b) is configured as the Cap Scenario.

The Plan Limit Scenario then is whichever of these has the lower result. Both scenarios have been run and are described in Section 3.2.1.

The categories of diversions included in the Plan limit definition are specified in the Water Sharing Plan. The limit estimated in the Plan is based on the river system model that was in use at that time. This included an estimate of floodplain harvesting, however this was not a reliable estimate as that part of the model was not sufficiently developed for that purpose.

A revised estimate of the Plan limit is being made as part of implementation of the policy. The same estimate will be used for the Baseline Diversion Limit (BDL) under the Basin Plan – consequently, the BDL estimate used by the Murray-Darling Basin Authority will also be updated, and by inference, the best available estimate of the Sustainable Diversion Limit (SDL).

As results are averaged (i.e. the long-term average annual extraction), the time period is critical. To comply with the Basin Plan, the period 01/07/1895 to 30/06/2009 is used for calculating long term averages for the implementation of the policy.

2.4 Eligible works capability assessment and determination of entitlements

The policy states that the determination of individual entitlements will not be based on history of use. Instead, determination is informed by a capability assessment that considers the works (physical infrastructure) used for floodplain harvesting and the opportunity to access floodplain

[2] The Cap is as defined in Schedule F of the *Murray Darling Basin Agreement* and as agreed under the *Murray Darling Basin Ministerial Cap on Diversions.*

flows based on location and climatic variability. Note that the assessment includes only those works deemed eligible for consideration[3].

This capability has been included in the rebuilt Border Rivers Valley river system model.

Growth in diversions above the Plan limit is addressed through two steps:

- Firstly, growth resulting from ineligible works is addressed by not including those works in the capability assessment or in the design of the entitlements
- Secondly, to bring diversions back within the Plan limit, entitlements are designed so that, in conjunction with the account management rules, each irrigation property has an equitable percentage reduction in long term average floodplain harvesting.

If total diversions are below the Plan limit, then the entitlements will be designed so that there is no impact. The assessment of impact is based on eligible works only.

To implement the above, 5 model scenarios are required to assess:

- the Plan limit (the Plan Limit Scenario)
- current infrastructure (the Current Conditions Scenario)
- eligible works (the Eligible Development Scenario)
- implementation of the policy (the Valley Scale Compliance Scenario)
- individual impacts of the policy compared to eligible works (the Individual Impact Scenario).

These scenarios are described in Section 3.

Determination of entitlement volumes depends on the accounting rules used. The proposed accounting rules are discussed in the following section. The method to calculate entitlements is further described in Section 3.2.4 on the implementation of the policy.

2.5 Proposed accounting rules

Accounting rules affect the sizing of entitlements; for example, if there is no carryover, larger entitlements are required to achieve the objectives of the policy. The amount of floodplain harvesting over the long term is affected by climate variability. These all need to be taken into account when designing entitlement volumes and account management rules. We undertook extensive analysis of combinations of entitlements and account management rules.

Issues such as equitable reductions and risk of growth in use were considered when evaluating the combinations of entitlement volumes and accounting rules. This process was overseen by an NSW interagency working group including the Department of Primary Industries (Fisheries), Department of Primary Industries (Agriculture) and DPIE - Energy Environment and Science. A summary of the analysis and recommendations were provided for stakeholder consultation to seek feedback (DPI, 2018a) and outcomes of the consultation were published (DPI, 2018b).

[3] The process of assessing eligible works is described in the *Floodplain Harvesting Policy Implementation Guideline* (DPIE, 2020).

The proposed accounting rules for each entitlement are:

- 100% of an entitlement to be credited annually to the account up to a maximum value of 500% of the entitlement.
- Annual floodplain harvesting is limited to the balance left in the account except where an overdraw is required to retain contaminated rainfall runoff from developed areas.
- The account is debited annually for all floodplain harvesting in that year, allowing for exclusions such as rainfall runoff harvesting during exempt periods.
- Any unused balance can be carried over into the next water year subject to the 500% account limit.

These proposed rules, along with some additional initialisation rules, will be further described during water sharing plan consultation (DPIE Water, 2020b). Appendix A illustrates how these accounting rules work.

NSW has introduced a partial rainfall runoff harvesting exemption to the policy, which means that there will be times when rainfall runoff harvested from the farm is not required to be accounted for against the licence. This provision is taken into account by removing exempted harvesting from results when determining the entitlement. The exemption is also reflected in the modelling of accounting rules. For modelling purposes:

- exempt rainfall runoff harvesting is defined as that which occurs from fallow or cropped areas on days when no water is being harvested from outside the farm[4].
- non exempt rainfall harvesting is considered part of floodplain harvesting and as such will be included in the floodplain harvesting results in this report.

[4] Draft regulation under the *Water Management Act 2000*, to be publicly exhibited in October 2020.

3 Scenarios: use and data

3.1 Overview

The intent of the policy is to bring floodplain harvesting into the water licensing framework, including managing any growth above statutory limits through a combination of entitlement volumes and account management rules as noted in Section 2.5. These two factors combined are hereafter referred to as the 'floodplain harvesting licensing framework'.

Four model scenarios have been developed to implement this framework in the Border Rivers (Table 1). The relationship between these scenarios is shown in Figure 2. A fifth scenario (Individual Impacts Scenario) is also used for reporting purposes as described later in this chapter.

Table 1 Scenarios developed to implement the floodplain harvesting licensing framework in the Border Rivers

	Scenario name	Description, including title used in Figure 2
(a)	Plan Limit Scenario	Plan Limit update There are two clauses in the Plan limit definition in the Water Sharing Plan; the Water Sharing Plan limit and the Murray Darling Basin Ministerial Council Cap on diversions. The Plan Limit Scenario is whichever has lesser long-term average total diversions
(b)	Current Conditions Scenario	Assess growth Current levels of development and management rules used to estimate the level of diversions without the licensing framework in place and determines the reduction, if any, required to comply with Plan limits
(c)	Eligible Development Scenario	Design entitlements In accordance with the policy, this scenario is based on the levels of farm infrastructure development that were present or otherwise eligible as at 3 July 2008. It is used to determine individual shares of the total volume of floodplain harvesting entitlements. We use the Individual Impacts Scenario to report on the individual impacts
(d)	Valley Scale Compliance Scenario	Demonstrate Plan limit compliance An evolution of the Current Conditions Scenario with the floodplain harvesting licensing framework applied to bring diversion back to statutory limits, with shares of the total floodplain harvesting entitlements based on distribution of floodplain harvesting volumes from (c)

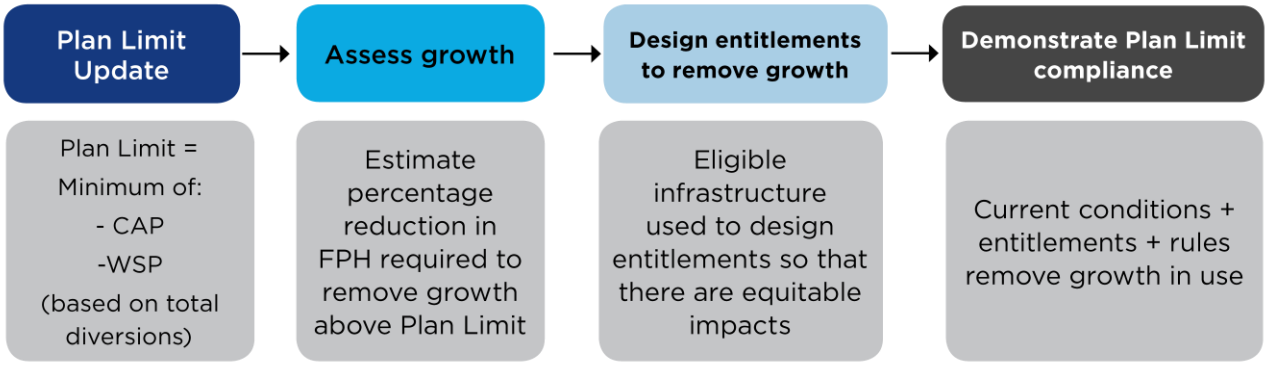

Figure 2 Process for using the model scenarios to determine floodplain harvesting entitlements. The four steps, moving from left to right, reflect the relationship between the four model scenarios

These scenarios are described in more detail in Section 2.2, including how the modelled implementation of the licensing framework equitably distributes impacts. The companion report which assesses environmental outcomes of the policy (DPIE Water, 2020b) uses the Current Conditions Scenario and Valley Scale Compliance Scenario.

3.2 Descriptions of scenarios

This section gives a general description of each model scenario. All model scenarios have been adapted from the 2008/09 Scenario described in the Model Build report (DPIE Water, 2020a). The Model Build report should be read in conjunction with this report for further detail on how the 2008/09 Scenario was developed and model performance assessed. Changes from that scenario are described in Section 3.3.

3.2.1 Plan Limit Scenario

The Plan limit is to be assessed through two separate scenarios as defined in the Border WSP and as described in Section 2.3. Depending on results, one of these scenarios becomes the Plan Limit Scenario. This is reported in Section 4.1.

Table 2 The two scenarios used to assess the Plan Limit

Scenario name	Description
Water Sharing Plan (WSP) Scenario	Reflects the level of development at June 2002 and management arrangements set out in the NSW Border Rivers WSP
CAP Scenario	Reflects agreements made under the Murray Darling Basin Ministerial Council Cap on diversions. For most valleys this generally referred to development and management arrangements at 1993/94. However, for the Border Rivers, the Ministerial Council agreed that the following allowance should be made for the enlargement of Pindari Dam[5]: • increased capacity of Pindari Dam from 37.5 GL to 312 GL • 1999/00 development levels for cropped areas and river pump capacities • 1993/94 development levels for on farm storages, associated pumps, and the valley water management rules.

The varying levels of development and management rules that should be used in each scenario are summarised in Table 3. Both scenarios have been built from the 2008/09 Scenario – this means that all other parameters are the same as those used in that scenario and as described in the companion Model Build report (DPIE Water, 2020a).

Table 3 Levels of development and management rules used in the Cap and WSP Scenarios

	Cap Scenario	WSP Scenario
On-farm storage capacity	30 June 1994	30 June 2002
On-farm storage pumps	30 June 1994	30 June 2002
Developed area	Nov 1999	30 June 2002
River pumps	Nov 1999	30 June 2002
Supplementary access rules	1993/94*	As per the WSP
Allowance for Pindari Stimulus	800 ML (400 ML over 2 days)	4,000 ML as per the WSP
Resource assessment	Annual accounting	Continuous accounting as per WSP

* There were no statutory surplus flow thresholds pre-WSP but operators have varied over time how they forecasted surplus flows above orders. We have calibrated the supplementary access so that the modelled diversions match observed for the period from 1993/94 to 2000/01.

For the WSP Scenario, the assumptions for Qld water use are those used by Qld for water resource planning. For the Cap Scenario, the default conditions are adopted: these are approximately equivalent to 2008 development. Technically the CAP Scenario should use 1993/94

[5] Pindari Dam was enlarged between 1991 and 1994. However ongoing dry conditions meant that the enlarged storage was not effective until 1996.

Qld conditions. However, previous testing has found that NSW diversions are not sensitive to the Qld water use assumptions. If the 1993/94 Qld conditions were to be adopted, this may cause a slight increase in the NSW diversions in the Cap Scenario.

3.2.2 Current Conditions Scenario

This scenario uses the best available information on most recent known levels of irrigation infrastructure and entitlements in the NSW Border Rivers, and existing management arrangements as defined under the Water Sharing Plan. The information is described in Section 3.3.

Apart from infrastructure and entitlements, the Current Conditions Scenario is the same as the 2008/09 Scenario.

This scenario is used to estimate diversions prior to implementing the floodplain harvesting licensing framework so as to assess whether there has been growth in total diversions compared to the Plan limit. It will require ongoing monitoring by the department to ensure that development levels continue to be kept up to date, to assess whether there have been behaviour changes. For example, future revisions will need to consider whether there are changes in cropping practices or irrigation efficiency and consider how entitlements purchased for environmental watering are used.

3.2.3 Eligible Development Scenario

This scenario is used to estimate the floodplain harvesting that would have occurred with only eligible infrastructure. This is used to determine the distribution of floodplain harvesting entitlements, as was described in Section 2.4.

All information on eligible works is provided by the NSW Natural Resources Access Regulator (NRAR) who conducted the eligible works assessment against the eligibility criteria in the policy on behalf of the Department of Planning, Industry and Environment.

It is the same as the 2008/09 scenario, with two exceptions:

- A small number of properties do not fully use their NSW supplementary entitlements in their NSW properties. For these, their supplementary entitlement has been reduced in the model scenario in line with their maximum annual historical usage.
- The 2008/09 Scenario includes representation of a reserve in on farm storages; this information was not available for all properties and has been removed from the Eligible Development Scenario to avoid inequalities.

3.2.4 Plan limit compliance

Plan limit compliance is assessed using two model scenarios to assess compliance at two scales – individual and valley.

Individual entitlements (Individual Impacts Scenario)

Entitlements were calculated by analysing the results from the Eligible Development Scenario using a utility program to simulate the effect of the proposed accounting rules on floodplain harvesting[6]. The utility estimates the entitlement which would be required, in conjunction with the accounting rules, to achieve the required impact on long term floodplain harvesting diversions. Impact is defined as a percentage reduction in long term average floodplain harvesting. Appendix A includes an illustration of how the accounting rules and impact is assessed.

The utility assumes that the same impact should apply to each individual entitlement. To test this, the entitlements and proposed accounting rules have been added into the Eligible Development

[6] The utility program was developed outside of the Border Rivers Valley river system model for efficiency (run-time) reasons.

Scenario to create a new scenario, the Individual Impacts Scenario. This can show some variations in impacts. However, the adopted methodology has minimised this variation as much as feasible, hence we refer to the outcomes as being equitable.

This process of designing the entitlement and assessing the impact of the rules takes into account the partial rainfall runoff harvesting exemption. The exemption is described in Section 2.5.

Valley scale (Valley Scale Compliance Scenario)

This scenario uses the Current Conditions Scenario and proposed accounting rules and individual floodplain harvesting entitlements to demonstrate modelled diversions comply with the plan Limit, which is set for the valley.

This scenario is not used to report on individual impacts as there may be other issues, such as entitlement changes, that cause changes in results compared to the Eligible Development Scenario.

3.3 Data for scenarios

The sources and characteristics of data for each model component are detailed in the companion Model Build report (DPIE Water, 2020a). Most of the data discussed relates to model calibration (data such as climate, inflows, crop water usage, transmission losses) and are therefore the same for each scenario. The model components that may vary between scenarios are:

- distribution of entitlements
- the level of irrigation infrastructure development in place
- crop model and planting decision assumptions
- management rules at the relevant point in time.

The data required for each of these components is summarised below.

3.3.1 Entitlements

The distribution of entitlements information comes from department databases and is available from the start of the Border Rivers WSP on 1 July 2009. All scenarios except the Current Conditions Scenario use the distribution of shares as at 1 July 2009. The Current Conditions Scenario uses the distribution of shares as at 30 June 2016. The total volumes are very similar (Table 4).

Table 4 Total Valley scale entitlements under all scenarios (shares)

Entitlement type	All scenarios except Current Conditions Scenario	Current Conditions Scenario
High security	1,500	1,500
General security A	22,114	22,027
General security B	242,123	241,211
Supplementary access	120,001	120,001

A small amount of NSW entitlement was purchased by the Commonwealth for environmental water use[7]. This entitlement has been represented as a consumptive water use with an irrigation pattern in the Current Conditions Scenario as not enough is known regarding how this held water will be used for environmental watering. This issue has been addressed in other reporting for Basin Plan compliance. We plan to explicitly represent how held environmental water is used in future versions of the model.

As noted in Section 3.2.3, the supplementary entitlement was reduced in line with maximum history in the Eligible Development Scenario for the few properties that did not fully utilise this water. This change meant that supplementary shares were reduced by 7,923 or 6.6% of the total in this scenario.

3.3.2 Development levels for scenarios

The farm development levels refer to the physical attributes of an irrigation property that provide ongoing capability to use water; specifically

- the area of the property that can be irrigated
- the additional area from which rainfall runoff can be harvested
- volumetric capacity of on-farm storages
- the rate at which water can be pumped both from the river as well as separately for floodplain harvesting.

Table 5 summarises the data types and sources of information used in each scenario. Note that the Current Conditions Scenario uses a range of dates; this is due to differences in availability of contemporary data for each data set.

Table 5 On-farm development types and sources of information used for each scenario

Farm development type	(Plan Limit) Cap Scenario	(Plan Limit) WSP Scenario	Eligible Development & Individual Impacts Scenarios	Current Conditions & Valley Scale Compliance Scenarios	Data sources
On-farm storage capacity (GL)	30 June 1994	30 June 2002	3 July 2008[1]	2020	LIDAR / storage survey
On-farm storage pump capacity (ML/d)	30 June 1994	30 June 2002	3 July 2008[1]	2020	NRAR works data[2]

[7] The entitlement data for the 2015/2016 water year included 420 ML of General Security B water, held by the Commonwealth for environmental water use. At 31 May 2020, total NSW Border Rivers holdings held by the Commonwealth Environmental Water Holder[1] comprise of 2,806 unit shares of general security B licences and 1,437 unit shares of supplementary licences. This represents around 1% of the total licences in the NSW Border Rivers. Larger volumes of Queensland entitlements have been purchased for Held Environmental Water; 15,540 medium priority and 19,986 unsupplemented shares as at 31 May 2020. [1] https://www.environment.gov.au/water/cewo/about/water-holdings

Farm development type	(Plan Limit) Cap Scenario	(Plan Limit) WSP Scenario	Eligible Development & Individual Impacts Scenarios	Current Conditions & Valley Scale Compliance Scenarios	Data sources
Floodplain harvesting intake rate (ML/d)	30 June 1994	30 June 2002	3 July 2008[1]	2020	NRAR works data[2]
Installed river pump capacity (ML/d)	Nov 1999	30 June 2002	3 July 2008	2014	Farm survey[3]
Maximum irrigable area (ha)	Nov 1999	30 June 2002	3 July 2008	2014	Farm survey[3]
Undeveloped farm area (ha)	Nov 1999	30 June 2002	3 July 2008	2014	Farm survey[3] and DEM[4]

[1] Eligible works as defined by NRAR, which may include some storages developed after 2008

[2] NRAR works data is data collected under the policy, primarily from site inspections

[3] The Farm Survey dataset covers water years from 1993/94 to 2013/14 but does not include all years in between and does not specify exact dates. It did not include years between 1999/00 and 2003/04 so we have interpolated to estimate 2002 data

[4] Digital Elevation Model (DEM) datasets were used to estimate local catchment areas

The valley total data used for each scenario is summarised in Table 6. These data include all regulated water user nodes in the NSW Border Rivers river system model (there are 3 unregulated water user nodes in the model that are not included in reporting of model results).

Table 6 On farm development levels estimates for the four development scenarios (Plan Limit Cap, Plan Limit WSP, Eligible Development and Current Conditions)

Farm development description	Plan Limit Cap	Plan Limit WSP	Eligible Development	Current Conditions
On-farm storage capacity (GL)	133	166	190	202
On-farm storage pump capacity (ML/d)	13,154	16,771	18,558	19,398
Floodplain harvesting intake rate (ML/d)	12,651	16,030	18,462	18,462
Installed river pump capacity (ML/d)	6,979	7,434	7,984	8,178
Maximum irrigable area (ha)	45,485	46,338	48,799	49,297
Undeveloped farm area (ha)	43,913	43,060	41,147	41,147

On farm storage capacity

We identified at an early stage that floodplain harvesting results are very sensitive to on-farm storage capacities. Significant effort has been put into improving the accuracy of this information by using LIDAR or photogrammetry data with verification against a sample of surveyed storages (Morrison and Chu, 2018). Where survey data were available, it was reviewed as part of a submissions process and adopted where suitable. This process, including the function of the Healthy Floodplains Review Committee, is further described in the *Implementation Guideline* (DPIE, 2020).

NRAR determined which of these storages were eligible under the policy and this information was used in the Eligible Development Scenario.

We determined which storages existed at earlier dates by using Landsat satellite imagery.

Pump capacity

Installed river pump capacity was based on farm survey data for all floodplain harvesting properties, and on earlier survey data for other relatively small water users. In a few cases, river pump capacity was revised in-line with maximum orders obtained from water order data.

On-farm storage pump capacity was estimated using NRAR works data. This data was developed based on on-site inspections that documented the size and type of work, including any upgrades. For a given pump type and size, a standard set of rates were adopted to determine the total on-farm storage pump capacity[8].

NRAR determined which pumps should be included in the Eligible Development Scenario. The on-farm storage capacity for earlier dates was based on the analysis of which storages existed at that date. Where there was no evidence that the storage existed at that date, the capacity of the associated lift pumps associated with that storage was not included in the Plan Limit Scenario.

The rate of intake of floodplain harvesting water into the property is generally set to the on-farm storage pump rate. Exceptions to this include either a lower rate where the intake is restricted by pipe capacities, or a higher rate to represent gravity filling of significant buffer storages[9].

A worked example, with diagram, to describe how the storage capacity, pump capacity and floodplain harvesting capacity were determined for different scenarios is provided in Appendix B .

Developed and undeveloped areas

The developed area refers to the area developed for irrigated cropping. Both developed and undeveloped areas were based on farm survey data for all floodplain harvesting properties. In a few cases, harvesting from a local catchment area was represented through additional undeveloped area, in which case elevation data was used to determine the catchment area.

For other relatively small water users, this information was based on earlier survey data as per the existing IQQM Water Sharing Plan model (DNRM & DLWC, 1998).

3.3.3 Crop model and planting decisions

Irrigation water use is estimated using a crop model component which: (i) estimates how much area is planted in that year based on water availability; and (ii) estimates irrigation water demand on the basis of daily historical climate data. The crop area planting component was derived by combining published data, farm surveys and remote sensing as described in the companion Model Build report.

[8] Rates are described in Appendix G of the companion Model Build Report (DPIE Water, 2020a)

[9] These rate exceptions are further described, with examples, in Appendix G of DPIE Water (2020a).

The crop model and planting decisions parameters and settings are the same as those in the 2008/09 Scenario and are fully described in the companion Model Build report.

3.3.4 Management rules

All scenarios, with the exception of the Cap Scenario, include the Border Rivers WSP rules as described in the companion Model Build report.

- The Cap Scenario includes changes to supplementary access rules and Pindari stimulus allowance as was detailed in Section 3.2.1.
- The proposed floodplain harvesting accounting rules are included in the two scenarios which test the impact of these rules; i.e. the Valley Scale Compliance Scenario and the Individual Impacts Scenario.

4 Results

The key results from running the scenarios through the Border Rivers Valley river system model relate to long-term average diversions prior to and with the estimated entitlements. These are reported in summary tabular and graphical format at valley scale in this section.

Diversions are reported for each entitlement category for the 1895 to 2009 Basin Plan comparison period and include annual time series graphs for total diversions. From this reporting, we are able to provide some commentary on key differences between scenarios.

The versions of the model used to run the scenarios are listed in Appendix C.

4.1 Plan Limit Scenario results

The WSP Scenario has a smaller long-term average total diversion than the Cap Scenario (Table 7). This means that the WSP Scenario defines the Plan limit and is referred to hereafter as the Plan Limit Scenario.

Table 7 Long term average total diversions under the Plan Limit Cap Scenario and Plan Limit WSP Scenario

Diversion category	Cap Scenario	WSP Scenario
General and high security	94.9	92.1
Supplementary access	77.0	69.2
Floodplain harvesting	31.8	38.7
Total	**203.8**	**200.0**

4.2 Growth in use assessment

The Plan Limit Scenario and Current Conditions Scenario were both configured in the river system model and run for the period of climate record (1889 to 2015). Results for the benchmark climate period defined in the Basin Plan (1 July 1895 to 30 June 2009) for categories of diversions were calculated and are summarised in Table 8.

Table 8 Predicted long term (1895 to 2009) average diversions (GL/year) under the Plan Limit Scenario and Current Conditions Scenario to determine growth in use

Diversion category	Plan Limit Scenario	Current Conditions Scenario
General and high security	92.1	92.6
Supplementary access	69.2	70.0
Floodplain harvesting	38.7	43.6
Total	**200.0**	**206.1**

This shows that, as a consequence of growth in development, total long-term average diversions have increased by around 6 GL/year. This is an increase of just over 3% for total diversions and around 13% for floodplain harvesting diversions. This growth needs to be reversed through the implementation of the policy by introducing entitlements and accounting rules.

The model also estimates exempt rainfall harvesting on farms that have applied for floodplain harvesting entitlements; under current conditions this has a long term average of 6.3 GL/year while under the Plan limit it is 5.8 GL/year. The floodplain harvesting framework is not designed to manage these diversions that also occur on non-floodplain harvesting properties. It is not proposed to alter the methods for estimated permitted and actual take for these interception activities under the Basin Plan.

4.3 Plan limit compliance results

The implementation of the Valley Scale Compliance Scenario (Section 3.2.4) brought the floodplain harvesting component of the NSW Border Rivers regulated river system below Plan limit levels as reported in Table 9 Predicted long term (1895 to 2009) average annual diversions (GL/year) under the Valley Scale Compliance Scenario compared to the Plan Limit Scenario. There were minor changes in other components that exceed Plan limit levels but are still less than the growth-in-use provisions of the Border Rivers WSP. As required by the Border Rivers WSP, we will assess whether any growth in use adjustments are required for general security or supplementary diversions in the annual Plan limit compliance assessments, and manage any growth in diversions pumped directly from the river under general security or supplementary water access licences by reducing the annual available water determinations for supplementary water access licences.

Table 9 Predicted long term (1895 to 2009) average annual diversions (GL/year) under the Valley Scale Compliance Scenario compared to the Plan Limit Scenario

Diversion category	Plan Limit Scenario (GL/year)	Valley Scale Compliance Scenario (GL/year)
General and high security	92.1	93.0
Supplementary access	69.2	71.2
Floodplain harvesting	38.7	38.0
TOTAL	**200.0**	**202.2**

The entitlements and account management rules will not have impacts on floodplain harvesting diversions in every year. In some years there will be no impact. The impacts will typically be during extended wet periods, when water accounts reach zero.

The variable impacts on floodplain harvesting are shown in Figure 3. The columns show the year to year variation with little apparent variation for most years. The greatest impact is apparent during wet periods when the accounting rules restrict diversions after the first wet year. For example, if the dry climate as experienced during the 1930s-40s were repeated, the floodplain harvesting rules would likely have no impact. Reductions in harvesting would start to occur however during the wetter climate experienced in the 1950s.

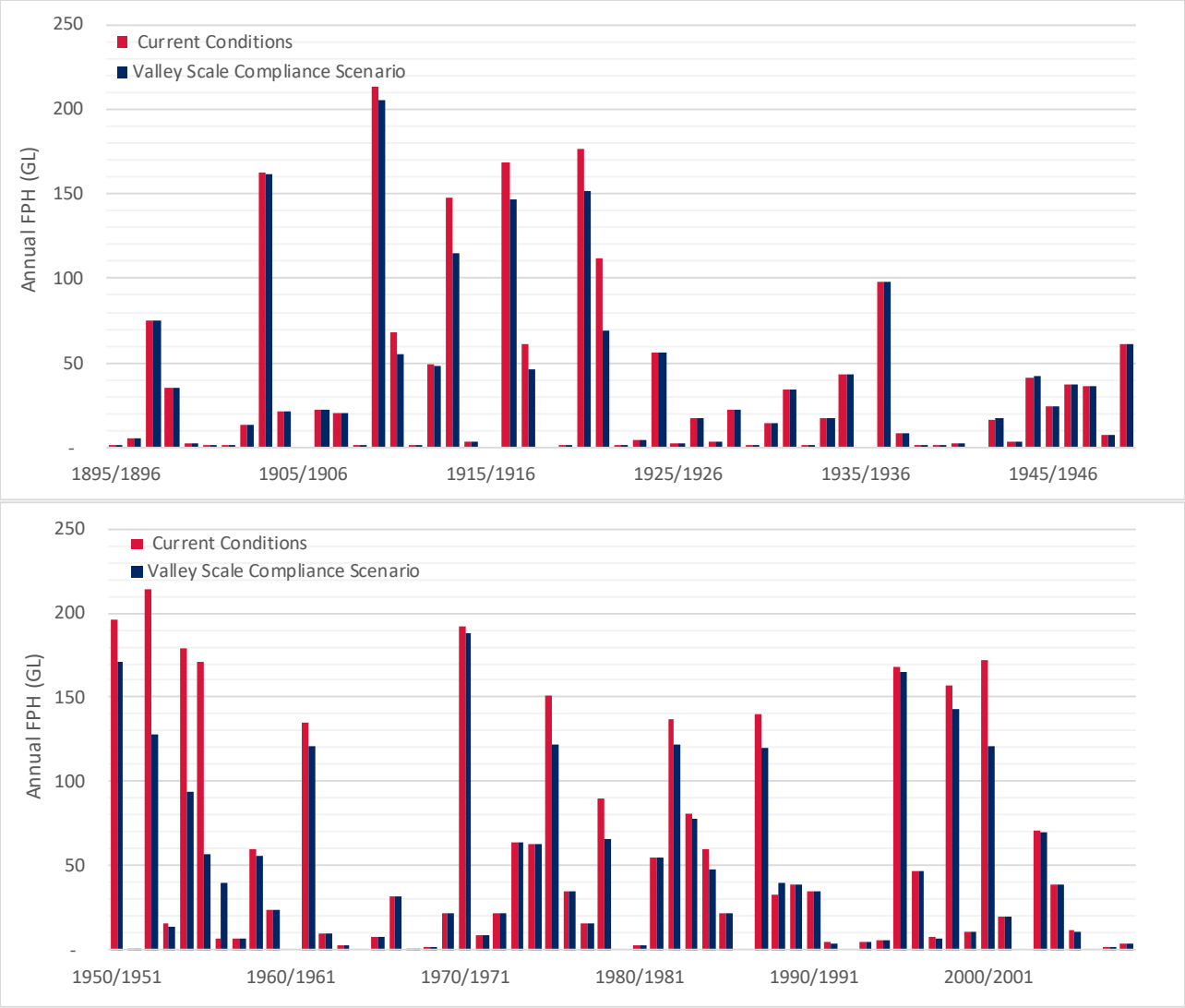

Figure 3 Predicted annual floodplain harvesting under the Current Conditions Scenario and Valley Scale Compliance Scenario over the periods 1895 to 1950 (top) and 1950 to 2009 (bottom)

4.4 Entitlement distribution

The entitlements have been designed so that the impacts required to remove growth in diversions above Plan limit are shared equitably. Some of the growth in floodplain harvesting is due to ineligible works; properties that have ineligible works will have larger impacts than other properties. In this assessment, we only consider the diversions that could take place with eligible works and how that would change after the entitlements and account rules are in place.

Impacts on individuals were tested using the Plan limit Individual Impacts Scenario[10]. This test allowed us to isolate all other changes which may have occurred in recent years (for example, changes in other entitlement products). The results confirm that the relative impacts on individual properties are very similar over the long term period.

Under implementation of this scenario, individual properties have a reduction in the floodplain harvesting diversion component over the 1895 to 2009 reporting period of around or less than 12%

[10] As described in Section 3.2.4, the Individual Impacts Scenario was created by adding the entitlements and accounting rules to the Eligible Development Scenario.

when compared to the Eligible Development Scenario. A 12% reduction means that post licensing, harvesting is 88% of what it would have been pre licensing. This ratio is shown in Figure 4 across the 36 properties[11]. Over the 36 properties (x-axis = 36), the smallest y-axis value is 88%, that is an overall reduction of 12%.

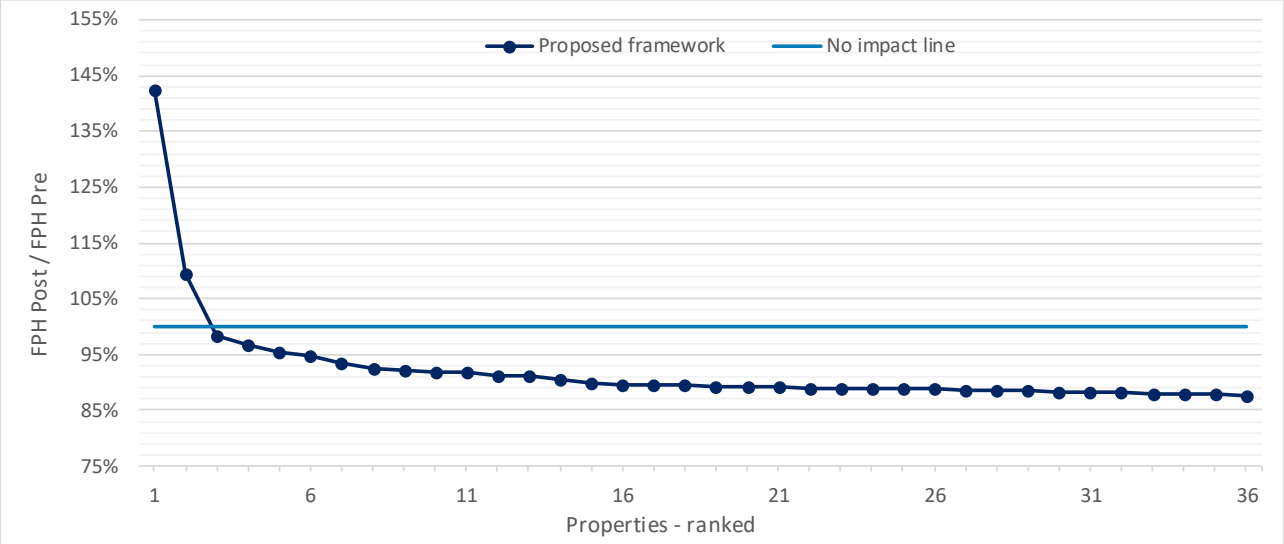

Figure 4 Distribution of change in floodplain harvesting diversions for individual properties under the Individual Impacts Scenario. The x-axis is the number of individual eligible properties represented in the Border Rivers Valley river system model

In some cases, the model indicates that some properties have impacts which are smaller than 12%. This is because when we model the rules, the reduction in upstream diversions increases the water availability for downstream properties. There can also be other interactions in the model which result in less impacts (e.g. if the rules restrict harvesting and create more airspace in the on-farm storage, this can lead to increased harvesting in the following year). There are 2 properties where the results indicate increased harvesting under the proposed licensing framework. In volume terms, this increase is relatively small. These 2 properties have very small average floodplain harvesting values (less than 25 ML/year); most of their harvesting would be taken under the rainfall harvesting exemption.

We have made a similar comparison using total diversions for individual properties which demonstrates smaller impacts and less variability in impacts.

[11] Those irrigation farms assessed as eligible for floodplain harvesting entitlements are represented individually in the model. The remaining, generally smaller, farms have been aggregated in the model within the river reach they are located. This resulted in 50 irrigator nodes, of which 36 represent individual eligible properties (or eligible enterprises consisting of several properties with one owner). There are 4 additional individual farm nodes in the model; one is not eligible and 3 are unregulated and the model is not used for their floodplain harvesting assessment. (Sourced from Section 6.2.2 DPIE Water, 2020a)

5 Conclusions and future work

Water Sharing Plans (WSPs) made under the *Water Management Act 2000* define how the limits to extractions are to be calculated within NSW water sources. The WSPs include an estimate of these limits which are also used as estimates of the Baseline Diversion Limit (BDL) and included in the Basin Plan. The Basin Plan allows for BDL estimates to be revised whenever a demonstrably better estimate is available.

The river system models used for the original WSPs and BDL estimates represented river diversions and flows to the best available standard of accuracy at that time and were independently reviewed as fit for that purpose; however, the floodplain harvesting diversions were not well represented.

As part of the policy, there has been significant investment in data and modelling to quantify floodplain harvesting more accurately. This has been incorporated into the current model of the Border Rivers regulated river system. The development of the model is described in the companion Model Build report (DPIE Water, 2020a).

The model has been used to create an updated estimate of the long term average annual extraction limit (LTAAEL), or Plan limit, as defined by the NSW Border Rivers WSP. There has been growth in infrastructure and subsequently we estimate a 13% increase in floodplain harvesting above the Plan limit estimate. We have used the model to determine floodplain harvesting entitlements in the Border Rivers regulated river system, which in combination with proposed accounting rules can remove this growth. The reduction in floodplain harvesting causes minor increases in other diversion categories; we will assess whether any growth in use adjustments are required for general security or supplementary diversions in future Plan limit compliance assessments as part of WSP reviews. This will require a more complete update of the Current Conditions scenario.

The work undertaken as part of implementing the policy has substantially reduced uncertainty in our estimates for floodplain harvesting. Despite this improvement, uncertainty can be further reduced with better information. The companion Model Build Report (DPIE Water, 2020a) lists several areas of future work. Three key areas of improvement are:

- review of floodplain harvesting measurement data following implementation of the policy to determine whether any further model improvements are required
- continued update of the Current Conditions Scenario, including consideration of irrigation behaviour changes and management of held environmental water
- better representation of return flows from floodplains to river channels. This will require further research to develop a methodology for addressing this limitation in the models.

6 References

Legislation, policies and plans

Basin Plan 2012. https://www.legislation.gov.au/Details/F2012L02240

(NSW) *Water Management Act 2000* No 92. Last updated 2020. https://legislation.nsw.gov.au/~/view/act/2000/92/

NSW Floodplain Harvesting Policy. First published May 2013, updated September 2018. http://www.water.nsw.gov.au/__data/assets/pdf_file/0012/548499/floodplain_harvesting_*Policy*.pdf. Referred to in this report as the policy

Border Rivers specific

(Draft) *Floodplain Management Plan for the Border Rivers Valley Floodplain 2018*. https://www.industry.nsw.gov.au/__data/assets/pdf_file/0010/146296/Draft-Floodplain-Management-Plan-for-the-Border-Rivers-Valley-Floodplain-2018.pdf

Water Sharing Plan for the NSW Border Rivers Regulated River Water Source 2009. Last updated 2018. https://legislation.nsw.gov.au/~/view/regulation/2009/218. Referred to in this report as the *NSW Border Rivers WSP*

Reports and journal articles

Alluvium (2019) Independent review of NSW Floodplain Harvesting policy implementation. A report for the NSW Department of Planning, Industry and Environment Water, Sydney. https://www.industry.nsw.gov.au/__data/assets/pdf_file/0004/272146/Final-floodplain-harvesting-independent-review.pdf

DNRM & DLWC (1998) Border Rivers System IQQM Implementation: Vol 2 of 7: Calibration Report: Dumaresq-Macintyre Rivers Subsystem (1986-1991). Department of Natural Resources and Management and Department of Land and Water Conservation.

DPI (2018a) Implementing the NSW Floodplain Harvesting Policy—Consultation paper. March 2018. NSW Department of Industry—Lands & Water. https://www.industry.nsw.gov.au/__data/assets/pdf_file/0009/318879/floodplain-harvesting-policy-consultation-paper.pdf

DPI (2018b) Outcomes paper from the NSW Floodplain Harvesting Consultation. June 2018. NSW Department of Industry—Lands & Water. (weblink)

Department of Planning, Industry and Environment (DPIE) (2020) Guideline for the implementation of the NSW Floodplain Harvesting Policy. March 2020. NSW Department of Planning, Industry and Environment. https://www.industry.nsw.gov.au/__data/assets/pdf_file/0007/272338/floodplain-harvesting-implementation-guidelines.pdf

Department of Planning, Industry and Environment Water (DPIE Water) (2020a) Building the river system model for the Border Rivers Valley regulated river system. NSW Department of Planning, Industry and Environment – Water

Department of Planning, Industry and Environment Water (DPIE Water) (2020b) Environmental outcomes of implementing the Floodplain Harvesting Policy: Border Rivers. NSW Department of Planning, Industry and Environment – Water

Morrison T, C-T Chu (2018) Storage Bathymetry Model Update and Application (Gwydir Valley), report prepared by Hydrospatial Pty Ltd for Department of Industry. https://www.industry.nsw.gov.au/__data/assets/pdf_file/0010/271936/Storage-bathymetry-model-update-and-application-gwydir.pdf

Appendix A Illustration of accounting rules

Table 10 illustrates how the proposed 5 yearly accounting rules work. The example does not include some of the account initialisation rules. The example is for a floodplain harvesting entitlement of 3,850 ML. Table 10 shows, for every year:

- unrestricted usage – the volume that could be harvested if no rules were in place
- restricted usage – how much could have been harvested with eligible works after the accounting rules are in place. It is the lesser of the unrestricted usage and the opening account balance
- opening and closing accounts keep track of the accounting rules:
    - the closing account is the opening account minus the usage (restricted usage)
    - the opening account is equal to the closing account from the prior year plus the annual water determination (AWD) of 100% (3,850 ML). The account is limited to the account balance limit of 500% of the entitlement (5 x 3,850 ML = 19,250). Any volume above this is forfeited.

Table 10 Example of annual floodplain harvesting under 5 year accounting rules. All units are in ML

Year	Unrestricted usage	Opening account	Restricted usage	Closing account
1	2,658	19,250	2,658[a]	16,592
2	586	19,250[b]	586	18,664
3	90	19,250	90	19,160
4	0	19,250	0	19,250
5	13,592	19,250	13,592	5,658
6	0	9,508	0	9,508
7	11,979	13,358	11,979	1,379
8	0	5,229	0	5,229
9	10,615	9,079	9,079[c]	0
10	8,344	3,850	3,850[c]	0
11	407	3,850	407	3,443
12	0	7,293	0	7,293
13	4,723	11,143	4,723	6,421
14	138	10,271	138	10,133
15	0	13,983	0	13,983
16	6,838	17,833	6,838	10,994

Year	Unrestricted usage	Opening account	Restricted usage	Closing account
17	226	14,844	226	14,618
Total	**60,197**		**54,166**	

[a] The account opens full at 500% of entitlement. The account balance is greater than unrestricted harvesting so there is no impact in this year and 2,658 ML is harvested.

[b] The account closed at 16,592 in the previous year and then 100% AWD is added at the start of the water year to give a total of 20,442ML. This is greater than the account balance limit so the opening account is reduced to the limit of 19,250ML.

[c] The unrestricted usage is larger than the opening account balance so harvesting is reduced in these years

You can see that in most years the accounting rules have no impact on harvesting; it is only in a cluster of wetter years that there are impacts. In this example, the entitlement, in conjunction with the rules, resulted in total harvesting over the period being reduced by 10%. This is a hypothetical example, for illustrative purposes.

We follow a similar process to determine entitlements with the exception that we use long term results. We scale the entitlements up and down until the required impact is achieved. This means that the determination of entitlement is dependent on the accounting rules adopted as the two things work together in the assessment to achieve the required impact.

Appendix B Worked example for development levels (scenarios)

The following describes an example property where there are multiple storages and floodplain harvesting intake points. Figure 5 is a schematic of the property. Data in this example are hypothetical, for the purposes of illustrating the modelling method.

The property has multiple works:

- two eligible storages with a total estimated pump capacity of 720 ML/day based on the works installed. Both storages were present at June 1994
- one ineligible storage built after 2008. The lift pumps associated with this storage (capacity 4,320 ML) have an estimated combined capacity of 360 ML/day
- multiple pipes bring water in from the channels into the developed part of the farm and allow delivery to the storages. The total capacity of these pipes was estimated at 768 ML/day assuming a 0.2m head.

For the Eligible Development Scenario, the on-farm storage pumps were considered the limiting factor. For the Current Conditions Scenario, the intake pipes are smaller in capacity and hence are adopted for the intake rate (Table 11).

Table 11 Hypothetical property works and their sizings under the various model scenarios

Parameter	Plan Limit – Cap & WSP Scenarios	Eligible Development Scenario	Current Conditions Scenario
On-farm storage capacity (ML)	6,520	6,520	10,822
On-farm storage pumps (ML/d)	720	720	1,080
Floodplain harvesting intake rate (ML/d)	720	720	768

The capacity of pumps and pipes are all determined using farm inspection works data provided by NRAR and standard rates for each type and size of work. This is described further in Appendix G4 of the companion Model Build report (DPIE Water, 2020a). In some cases, there was additional information about upgrades to pumps on storages. This information was sometimes contained in the farm survey or NRAR notes; these were reviewed and adopted where relevant for historical scenarios.

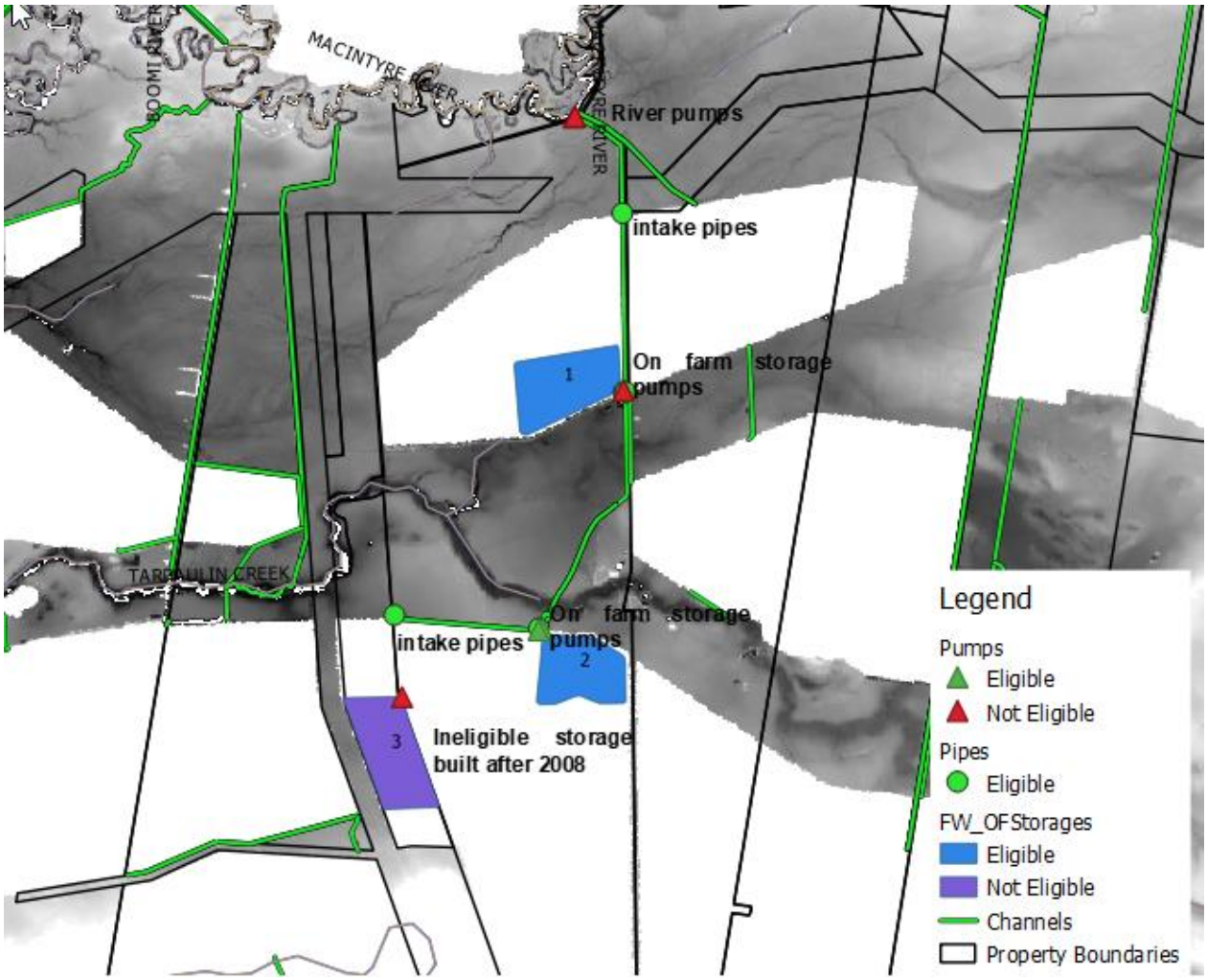

Figure 5 Example property with multiple storages and intakes

Appendix C Model version

All scenarios have been developed with the following version of the model:

- Source file name: BorderRivers_2020_09_02.rsproj
- Source version: 4.11.0.10112

Each scenario is implemented by selecting a different scenario input set contained within this Source file (Table 12).

Table 12 Input sets for model scenarios

Scenario	Scenario Input Set
Plan Limit Scenario	Default Input Set.QLD_ROP.ROP_On.NSW_BDL
Current Infrastructure Scenario	Default Input Set.NSW_1516
Eligible Development Scenario	Default Input Set.FPHeligible_unconstrained
Individual Impacts Scenario	Default Input Set.FPHeligible_unconstrained.fphscale
Valley Scale Compliance Scenario	Default Input Set.NSW_1516.NSW_1516_fphscale

Appendix D Glossary

Table 13 Abbreviations and acronyms

Abbreviation/ acronym	Expansion
BDL	Baseline diversion limit
LTAAEL	Long term average annual extraction limit
NRAR	Natural Resources Access Regulator
SDL	Sustainable diversion limit
WSP	Water Sharing Plan

Table 14 Terms

Term	Description
2008/09 Scenario	Model baseline scenario representing floodplain harvesting works in place in 2008/09. The derivation of this baseline scenario is described in companion Model Build report
2020/21 water year	A water year runs from 1 July to 30 June, in this example from 1 July 2020 to 30 June 2021. A slash is used to identify this and to be consistent with Basin legislation. (2020-2021 would refer to the range of years, 2020 and 2021)
Cap Scenario	Model scenario that reflects agreements made under the Murray Darling Basin Ministerial Council Cap on diversions. Candidate for the Plan Limit Scenario (details in Table 2)
Current Conditions Scenario	Model scenario that uses the best available information on most recent known levels of irrigation infrastructure and entitlements (details in Section 3.2.2)
Eligible Development Scenario	Model scenario used to estimate the floodplain harvesting that would have occurred with only eligible infrastructure (details in Section 3.2.3)
Long-term average annual extraction limit (LTAAEL)	The upper limit on the average of annual extractions from the water source over the period for which an assessment is carried out. (Source: https://www.waternsw.com.au/customer-service/service-and-help/tips/glossary#l)
NSW Border Rivers WSP	Shortened term for the Water Sharing Plan for the NSW Border Rivers Regulated River Water Source 2009
Plan limit	The authorised long-term average annual extraction limit as defined in the Water Sharing Plan
Plan limit compliance	Compliance with the Plan limit, which is assessed using long-term modelling.

Term	Description
Plan Limit Scenario	Model scenario that results in the lower long-term average diversions from either the conditions set out in the Water Sharing Plan or agreements made under the Murray Darling Basin Ministerial Council on diversions (derivation for each valley described in companion Scenarios reports). Selected from the CAP Scenario and the WSP Scenario
the policy	Shortened term for the *NSW Floodplain Harvesting Policy*
Water Sharing Plan (WSP) Scenario	Model scenario that reflects the level of development specified in the Water Sharing Plan. at For the NSW Border Rivers, this is the level of development at June 2002 and management arrangements set out in the NSW Border Rivers WSP. Candidate for the Plan Limit Scenario (details in Table 2)